CLAIMS

[1] A solar cell comprising:

a substrate;

a conductive film formed on the substrate;

a compound semiconductor layer formed on the conductive film, the compound semiconductor layer including a p-type semiconductor crystal containing an element of Group Ib, an element of Group IIIb, and an element of Group VIb;

a n-type window layer formed on the compound semiconductor layer, the n-type window layer having an aperture; and

a n-type transparent conductive film formed on the n-type window layer and on a portion of the compound semiconductor layer at the aperture of the n-type window layer,

wherein

the compound semiconductor layer includes a high-resistance part, the high-resistance part being located in a portion of the compound semiconductor layer in the vicinity of a surface thereof on a side opposite to the conductive film, the high-resistance part containing a n-type impurity doped in the p-type semiconductor crystal, and

the high-resistance part is located under the aperture of the n-type window layer.

[2] The solar cell according to claim 1, wherein

the high-resistance part has a resistance higher than a resistance of the n-type window layer.

[3] The solar cell according to claim 1, wherein

the compound semiconductor layer has a recessed surface on its face

on the side opposite to the conductive film, and

the high-resistance part is formed in the vicinity of the recessed surface.

[4] The solar cell according to claim 1, wherein

the n-type transparent conductive film is connected with a part of the compound semiconductor layer other than the high-resistance part only via at least either one of the n-type window layer and the high-resistance part.

[5] The solar cell according to claim 1, wherein

the high-resistance part contains, as the n-type impurity, at least one element selected from the group consisting of the elements of Group IIa and the elements of Group IIb.

[6] The solar cell according to claim 1, wherein

the n-type impurity of the high-resistance part is Zn, Mg, or Ca.

[7] The solar cell according claim 1, wherein

the p-type semiconductor crystal of the compound semiconductor layer is a chalcopyrite-structured $CuInSe_2$ crystal, a chalcopyrite-structured $Cu(Ga,In)Se_2$ crystal, or a chalcopyrite-structured $CuIn(S,Se)_2$ crystal.

[8] The solar cell according to claim 1, wherein

the n-type window layer is a ZnO film or a ZnMgO film.

[9] The solar cell according to claim 1, further comprising:

a n-type buffer layer formed between the compound semiconductor layer and the n-type window layer, the n-type buffer layer having an aperture

that is connected with the aperture of the n-type window layer.

[10] The solar cell according to claim 9, wherein

the n-type buffer layer is a Zn(O,OH) film or a Zn(O,S,OH) film.

[11] The solar cell according to claim 1, wherein

the n-type transparent conductive film is an ITO film, a SnO_2 film, an In_2O_3 film, a ZnO:Al film, or a ZnO:B film.

[12] The solar cell according to claim 1, wherein

the substrate is a glass substrate containing at least one alkali metal element selected from the group consisting of Na, K, and Li, and

a difference between a coefficient of linear expansion of the substrate and a coefficient of linear expansion of the p-type semiconductor crystal is within a range of not less than 1×10^{-6}/K and not more than 3×10^{-6}/K.

[13] A solar cell producing method comprising the steps of:

forming a conductive film on a substrate;

growing a p-type semiconductor crystal on the conductive film, the p-type semiconductor crystal containing an element of Group Ib, an element of Group IIIb, and an element of Group VIb;

forming a n-type window layer on the p-type semiconductor crystal, the n-type window layer having an aperture; and

forming a n-type transparent conductive film on the n-type window layer and on a portion of the p-type semiconductor crystal at the aperture of the n-type window layer,

the solar cell producing method further comprising the step of doping an n-type impurity in the p-type semiconductor crystal, in the vicinity of a

surface of the p-type semiconductor crystal under the aperture of the n-type window layer, the doping step being carried out between the step of forming the n-type window layer and the step of forming the n-type transparent conductive film.

[14] The solar cell producing method according to claim 13, wherein in the step of doping the n-type impurity in the p-type semiconductor crystal, an impurity film is formed by depositing the n-type impurity by a vapor deposition method or an evaporation method on the n-type window layer and the portion of the p-type semiconductor crystal that is exposed at the aperture of the n-type window layer, and the n-type impurity in the impurity film is diffused by a heat treatment into the portion of the p-type semiconductor crystal.

[15] The solar cell producing method according to claim 13, wherein in the step of doping the n-type impurity in the p-type semiconductor crystal, an impurity film is formed by depositing the n-type impurity by plating on the portion of the p-type semiconductor crystal that is exposed at the aperture of the n-type window layer, and the n-type impurity in the impurity film is diffused by a heat treatment into the portion of the p-type semiconductor crystal.

[16] The solar cell producing method according to claim 14 or 15, further comprising the step of removing the impurity film, the step of removing the impurity film being carried out between the step of doping the n-type impurity in the p-type semiconductor crystal and the step of forming the n-type transparent conductive film.

[17] The solar cell producing method according to claim 13, wherein in the step of doping the n-type impurity in the p-type semiconductor crystal, the n-type impurity is implanted by ion implantation into the portion of the p-type semiconductor crystal via the aperture of the n-type window layer.

[18] The solar cell producing method according to claim 17, wherein in the step of doping the n-type impurity in the p-type semiconductor crystal, a heat treatment is carried out additionally, after the n-type impurity is implanted.

[19] The solar cell producing method according to claim 13, further comprising the step of forming a n-type buffer layer having an aperture, the step of forming the n-type buffer layer being carried out between the step of growing the p-type semiconductor crystal and the step of forming the n-type window layer.